UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NPRDC TR 84-42	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A FRAMEWORK FOR INTEGRATING ALTERNATIVE MILITARY MANPOWER SUPPLY METHODS		5. TYPE OF REPORT & PERIOD COVERED 6. PERFORMING ORG. REPORT NUMBER 61-84-5
7. AUTHOR(s) Jules I. Borack		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Navy Personnel Research and Development Center San Diego, California 92152		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS In-house independent laboratory research
11. CONTROLLING OFFICE NAME AND ADDRESS Navy Personnel Research and Development Center San Diego, California 92152		12. REPORT DATE May 1984 13. NUMBER OF PAGES 34
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Manpower supply
Econometric models
Surveys
Demographic techniques
Accession planning

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Although military planners and researchers have used the phrases "supply of manpower for military service" or "military personnel supply" with increasing frequency, there is no commonly accepted definition of "military manpower supply." This report addresses three principal methods used in personnel supply research, describing how supply is defined within each, along with corresponding strengths and weaknesses. Since no single approach provides a comprehensive understanding of supply, a prospectus for integrating these methods into a logical framework is presented.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-LF-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

NPRDC TR 84-42

MAY 1984

A FRAMEWORK FOR INTEGRATING ALTERNATIVE MILITARY MANPOWER SUPPLY METHODS

NAVY PERSONNEL RESEARCH
AND
DEVELOPMENT CENTER
San Diego, California 92152

NPRDC TR 84-42

May 1984

A FRAMEWORK FOR INTEGRATING ALTERNATIVE MILITARY MANPOWER SUPPLY METHODS

Jules I. Borack

Reviewed by
J. Silverman

Approved by
M. Wiskoff

Released by
J. W. Renard
Captain, U.S. Navy
Commanding Officer

Navy Personnel Research and Development Center
San Diego, California 92152

FOREWORD

The research was conducted within the in-house independent laboratory research program. The objectives of this specific effort were to compare the diverse methods used by military manpower supply specialists in the supply/accessioning process and to develop a prospectus for integrating them into a logical framework. Results should be useful in structuring a new generation of manpower supply models.

J. W. RENARD
Captain, U.S. Navy
Commanding Officer

J. W. TWEEDDALE
Technical Director

SUMMARY

Problem

Although military manpower specialists have used the phrases "supply of manpower for military service" or "military personnel supply" with increasing frequency, there is no commonly accepted definition of the term "military manpower supply." Rather, the concept of "supply" appears to relate not so much to an underlying phenomenon, as it does to the method used by an individual planner or researcher. Because of the bewildering assortment of estimates and projections, a prospectus that combines various "supply" methods into a logical framework is needed.

Objectives

The primary objectives of this effort were to analyze the principal methods used by military manpower supply specialists and to suggest a prospectus for combining them into a logical framework.

Approach

Three distinct methods used by "supply" researchers were analyzed: (1) econometric model development, (2) surveys of interest/intentions to join the military, and (3) demographic analyses.

Results

The definitions of supply inherent in the approaches addressed are quite dissimilar. Econometric models define supply as the expected value of "high-quality" contracts or accessions; surveys, as the number and composition of individuals who are planning (or are interested in) a military career; and demographic approaches, as the number and composition of individuals who are able to fulfill military entrance criteria.

Each method possesses several strengths and weaknesses. Econometric models are easy to implement and define supply in a directly useable fashion. However, they are unable to incorporate variables that are not directly quantifiable and cannot be easily developed for demand-constrained or nontraditional populations. Conversely, manpower supply surveys do not define supply in a directly implementable manner but are very useful in measuring the relative size of a supply pool. In addition, these surveys investigate the entire spectrum of the nation's youth--not only those who have chosen to join the military. Finally, demographic approaches are useful in providing a tool for assessing the impact of alterations in accession standards. Demographic techniques, however, do not by themselves aid in the assessment of key policies that would permit the military to balance supply and demand efficiently.

Conclusions and Recommendations

These findings indicate that no single method provides all the information necessary for a full understanding of the accessioning process. A "good" supply model should use the best demographic techniques to establish accurate "bottom-line" populations and combine them with interest/intent data obtained through surveys and relevant economic predictors. A logical framework that integrates these diverse approaches represents supply as a dynamic interplay rather than a specific model, survey, or analysis.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Problem

With the advent of the all-volunteer force (AVF) in the United States, the ability to estimate and project the supply of available military manpower assumes greater significance. Under a draft environment, the general assertion is that the United States possesses a sufficiently large pool of manpower for use under potential wartime and peacetime scenarios. However, under an AVF framework, debate regarding the potential cost and substainability of the armed forces during a period of proposed manpower increases continues.

Although military planners and researchers use the phrases "supply of manpower for military service" or "military personnel supply" with increasing frequency, there is no commonly accepted definition of the term "military manpower supply." Indeed, the concept of "supply" appears to relate not so much to an underlying phenomenon as it does to the method used by the individual researcher or planner. For example, it is common to look at population projections similar to the data presented in Figure 1 and encounter statements such as "the supply of individuals for military service will decline by 20-25 percent during the 1980s and 1990s" (Borack & Govindan, 1978). Similarly, it is not unusual to see remarks such as "the supply of Navy recruits will approximately equal 68,400 in 1985" (Goldberg, 1982). Although these statements both relate to supply, they are not measuring the same concept. Because of the bewildering assortment of estimates and projections, it appears that a prospectus that combines various supply methods into a logical framework would be of value if not essential.

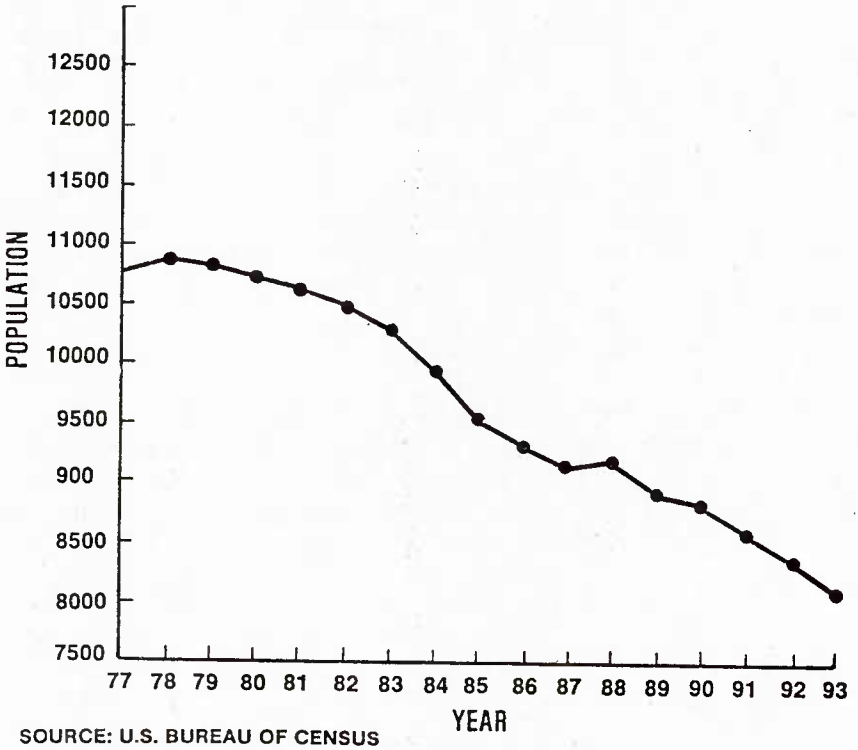


Figure 1. U.S. male population age 17-21 (in thousands).

Background

Table 1 presents percentages for Navy non-prior-service accessions for the AVF period 1974-1983. Surprisingly, total accessions have actually decreased during this time frame. However, the quality of accessions, as measured by the percentages having a high school diploma or a score sufficiently high on the Armed Forces Qualification Test (AFQT) to place one in mental level categories I to IIIA, has risen discernably. Also, note that the percentages of female and black accessions have remained fairly constant, while the percentage of hispanics has increased slightly.

Table 1

Navy Non-prior-service Accessions--FY74-83

FY	Total	Males				Females (%)
		High School Graduate (%)	Mental Categories I-IIIA (%)	Black (%)	Hisp. (%)	
1974	90,051	59.8	60.9	11.1	NA[a]	7.5
1975	98,449	64.4	64.7	10.3	3.7	6.9
1976	91,544	65.5	71.4	8.7	2.0	5.6
1977	98,981	70.2	56.0	11.5	3.6	4.8
1978	78,838	63.6	58.9	12.7	3.7	7.1
1979	77,381	66.9	55.4	15.7	3.7	11.2
1980	85,497	68.4	59.9	13.2	3.1	12.2
1981	89,690	68.2	61.9	12.4	2.4	10.8
1982	76,240	70.4	62.9	13.2	3.5	10.2
1983	71,606	82.0	67.9	13.6	4.6	11.4

Note. Data obtained from the Defense Manpower Data Center (DMDC).

[a]NA = Not available.

Table 2, which presents the proportions within demographic subgroups scoring in mental categories I-IIIA, shows that quality has been improving within each of these subgroups, as well as overall. Finally, Table 3 presents the percentage of male accessions composed of "older" individuals. As shown, the percentage has more than tripled.

Table 2

Navy NPS Accessions
Upper Mental Category (I-IIIA) Proportions

FY	Black Males (%)	Hispanic Males (%)	Females (%)
1974	27.4	NA[a]	47.8
1975	28.6	45.6	66.0
1976	44.7	54.8	74.2
1977	26.8	38.3	72.9
1978	30.4	40.8	70.9
1979	24.5	37.8	64.0
1980	25.7	42.6	57.7
1981	29.8	47.4	64.4
1982	33.3	44.8	66.5
1983	37.2	48.2	69.4

Note. Data obtained from DMDC.

[a]NA = Not available.

Table 3

Navy Non-prior-service "Older" Male Accessions

FY	Age 22 & Older (%)	Median Age	Some College (%)
1974	5.1	18.6	6.4
1975	7.9	18.8	7.5
1976	9.6	18.9	8.6
1977	10.5	18.9	2.1
1978	10.6	18.8	7.6
1979	10.4	18.9	5.9
1980	12.2	19.0	5.2
1981	13.9	19.1	5.5
1982	16.7	19.3	6.2
1983	18.3	19.5	8.0

Note. Data obtained from DMDC.

These tables are but a limited subset of all available accession data. It is important to note, however, that accessions are not synonymous with supply. As Thomas (1983) observes:

> Most supply analyses use data from people who have already enlisted. Even if managers become very good at predicting the supply of similar future enlistees, such enlistees may not be the most preferred recruits. Rather, the most desired group may well be among those who are not currently enlisting. Supply modellers and the users of supply models need to be very knowledgeable about the supply pool that is not choosing military employment. (p. 4)

Objectives

The primary objectives of this effort were to analyze principal methods used in personnel supply research and to suggest a prospectus for combining them into a logical framework.

METHOD

Three distinct methods for investigating the "supply" issue were analyzed: (1) econometric models, (2) surveys of interest/intentions to join the military, and (3) demographic analyses.

RESULTS

Econometric Models

The econometric model is perhaps the most widely used technique for evaluating military personnel supply. Typically, econometric manpower supply models attempt to estimate or predict the number of contracts signed by (or actual enlistments of) "high-quality" young males based upon variables deemed to be related (in an aggregate sense) to the enlistment decision. Such models typically use standard econometric regression-based techniques and tend to be either time-series, cross-sectional or pooled time-series, cross-sectional in nature. Table 4, which presents a summary of prominent econometric models developed for studying young male enlistments, shows "supply" as a function of various measurable predictors. In Table 4, supply is defined as "contracts signed by high-school diploma graduates," "accessions of mental grade I-IIIA high-school graduates," etc. To an econometric model builder, supply generally represents an expected value of "high-quality" contracts or accessions. Table 5 categorizes the variables used in these models under five distinct categories. Many of the listed models are composed of one or more predictor variables from several of these categories.

To exemplify the usefulness of econometric supply models, Table 6 presents predictions derived from an econometric model (Goldberg, 1982) for accessions who are in mental groups I-IIIA and who are high-school diploma graduates. To use such models in a forecasting mode, assumptions must be made about the values of the independent variables (see footnote to Table 6). Although such variables are often not difficult to predict if they are set by the military (e.g., recruiters), such is not the case for external

Table 4

Summary of Econometric Models Developed for Studying Young Male Enlistments

Study	Service	Dependent Variables	Explanatory Variables	Indicators	Data	Estimation
Amey, Fechter, Huck & Midlam (1976)	Army Navy	(HSDG I-II, HSDG III, total I-III, NHSDG I-III contracts)/ 17-21 male QMAs	RMC/civilian income for 17-21 males, youth UNR, advertising $, recruiters/QMAs, % black QMAs	Region	CY 1970-74 annually by 9 census regions	Linear, log-linear by OLS and TSLS
Ash, Udis, & McNown (1983)	DoD, all services	(Total contracts, total accessions, white accessions, nonwhite accessions)/18-19 year-old male population	Civ/mil pay (-1), youth unemployment rate (UNR), induction probability	Time trend	1967II-76II semi-annually	Linear by TSLS
Brown (1983)	Army	(Total contracts, AFQT I-IIIA, 18-20 population, high-school diploma graduates (HSDG) contracts, HSDG I-IIIA)/HS graduates	RMC, VEAP/RMC, civilian wage (each in constant $), UNR, UNR-squared, (recruiters, DoD recruiters, national/local advertising)/18-20 population	Time trend, state, quarter	1975IV-82III quarterly by state	Log-linear by OLS
Cotterman (1983)	All services	HSDG I-IIIA contracts/17-21 male population	RMC/civilian earnings, state UNR-US UNR deviation, recruiters/17-21 male population	GI bill, season, state	10/74-3/81 monthly by state	Log-linear by GLS
Cowin, O'Connor, Sage, & Johnson (1980)	Navy	(AFQT I-IIIA, AFQT IIIB-IVA, HSDG, non-HSDG contracts)/17-21 male population, females, nonwhite school-eligible, nonwhite not school-eligible contracts	UNR, UNR (-6 mos), % employed, civilian wage, expected civilian wage, change in civilian wage, recruiters/17-21 male population, % nonwhite, % military population	Region	1975-2 to 1976-2 semi-annually by Navy recruiting area	Linear, log-linear by OLS
Dale, & Gilroy (1983)	All services	(Total HSDG contracts, white & black HSDG contracts)/16-19 male population	RMC/civilian pay (+4), UNR, UNR (-2) (all for 16-19 males), GI bill/CPI, VEAP, bonus	GI bill, season	10/75-3/82 monthly	Linear by OLS and GLS
De Vany, & Saving (1982)	Air Force	(AFQT I-II contracts, AFQT III-VI contracts)/16-19 male population	Mil/civilian wage, employment rate, USAF recruiters/DoD recruiters, inductions/16-19 male population	Season	6/69-6/76 monthly	Log-linear by TSLS
Donelan (1977)	Navy	Age 17-21 AFQT I-II accessions	UNR, % urban QMA, % rural QMA, % black QMA, recruiters (weighted)	None	FY 1975 annually by NRD	Linear-interaction, quadratic, logit, log-interaction, by stepwise LS
Fernandez (1979)	All services	(Total HSDG, HSDG I-II, HSDG IIIA, HSDG IIIB contracts)/17-21 male population	RMC/civilian earnings, lagged youth UNR, recruiters, minimum wage	Month, FY 1978	7/1970-9/78 monthly	Linear, log-linear by OLS
Goldberg (1982)	All services	Total HSDG, HSDG I-IIIA, HSDG I-II contracts	RMC/civilian pay, UNR, (youth job program $, countercyclical job program $, blacks)/17-21 male population, total 17-21 male population, Navy, Army, USAF, USMC recruiters	VEAP	FY 1976-80 annually by recruiting district	Log-linear by OLS
Goldberg, & Greenston (1983)	All services	HSDG I-IIIA contracts, HSDG IIIB contracts	RMC/civilian earnings, change in UNR, avg UNR, 17-21 male population, % black males, % urban population of 17-21 males, Navy, Army, USAF, USMC recruiters	VEAP, USAF policies	FY 1976-82 annually by recruiting district	Log-linear by OLS

Table 4 (Continued)

Study	Service	Dependent Variables	Explanatory Variables	Indicators	Data	Estimation
Greenston, & Toikka (1978)	Navy	HSDG I-II, HSDG III, HSDG IV, NHSDG I-II, NHSDG III, NHSDG IV contracts	Male youth UNR (-2), military pay (-2)/real 18-21 male civilian pay (-1), 17-21 male population, quota/total contracts	Season	1970III-77IV quarterly	Log-linear by OLS
Grissmer (1977)	DoD, all services	(HSDG I-II, HSDG III, NHSDG I-III, total I-III, black HSDG I-III, nonblack HSDG I-III contracts)/17-21 male population	Mil/civilian pay, youth UNR	Season	6/1970-7/75 monthly	Linear, log-linear by OLS
Grissmer, Amey, Arms, Huck, Imperial, Koenig, Moore, Sica, & Szymanski (1974)	DoD, all services	(Total age 17-18, total age 19-21, AFQT I-II, AFQT I-III, total HSDG, total NHSDG, black HSDG, black NHSDG contracts)/QMAs	Mil/civilian wage, youth UNR, recruiters/QMAs, male HSDGS/male college enrollments, military residents/population, bonus, advertising $	Season	CY 1972-73 annually and CY 1971-73 monthly by state	Linear, log-linear, by stepwise LS
Hanssens, & Levien (1983)	Navy	Leads, delayed entry pool (DEP), direct shipment contracts/17-21 male population	(Civilian earnings, UNR, % black, % urban, % HS seniors, YATS propensity, recruiters, recruiting $, advertising $, direct shipment goal, DEP (-1))/17-21 male population	GI bill, season	1/76-12/78 monthly by NRD, pooled cross-section (CS), time series (TS)	Log-linear by OLS
Huck, & Allen (1978)	DoD, all services	Total HSDG I-IIIA, white HSDG I-IIIA, nonwhite HSDG I-IIIA contracts	Civilian mfg pay, UNR, recruiters, QMAs (17-21 male HSDG I-IIIA, not in college)	None	CY 1975 by state	Log-linear, Cobb-Douglas by Gauss-Marquandt LS
Jehn, & Shughart (1976)	Navy	(Total contracts, HSDG I-IIIA contracts)/17-21 male population	UNR, per capita income, % black, % urban, median years of education, % mfg workers, % net migration (1960-70), recruiters, male enlistment quota	None	CY 1973 and CY 1975 annually by NRD	Logit, log-interaction by OLS
Morey (1980)	Navy	Total HSDG, HSDG I-IIIA contracts, leads	RMC/civilian pay, UNR, youth UNR, % urban, DEP, YATS propensity, recruiters, minority and overall recruiting $, advertising $, HS seniors, % black	District	1/1976-12/78 monthly by recruiting district	Linear, log-linear by OLS and TSLS
Morey, & McCann (1980)	Navy	(Total contracts, HSDG contracts, leads)/labor force	(Unemployed population, leads, advertising $, recruiters, HS seniors, dependent variable (-1))/labor force	GI bill, district, month, year	CY 1976/77 monthly by NRD, pooled CS-TS	Log-linear by OLS
Siegel, & Borack (1981)	Navy	Total HSDG contracts/HSDG male population	Civilian/basic military pay, (UNR recruiters (weighted), HDSG accession goal)/HSDG male population, YATS employment prospects, YATS propensity	None	FY 1977-79 annually by NRD, pooled CS-TS	Log-linear interaction by seemingly unrelated regression
Van Doren (1981)	Navy	(Total HSDG, HSDG I-II contracts)/17-21 male population	18-year-old male earnings/RMC, UNR, 17-21 male population, recruiters/17-21 male population	None	FY 1976-80 annually	Linear, log-linear, logistic by OLS

Table 5

Summary of Econometric Variables

Variable Category	Examples
External Economic	Civilian earnings Unemployment rate Employment prospects Youth job programs Per capita income
Demographic	Percent black Percent nonwhite Percent urban High school seniors College enrollments Percent military residents Percent manufacturing workers Median years of education Net migration
Military Compensation	Regular military compensation Basic military pay Bonsuses VEAP/GI bill
Recruitment Effort	Number of recruiters (weighted) Recruiting and promotion expenditure National, local advertising expenditure Other DoD recruiters
Goals (Demand)	Direct shipment goal Contract goal HSDG accession goal Size of delayed entry pool (DEP)
Other (Non-AVF)	Number of inductions

Table 6

Predictions for MG I-IIIA and All HSDG Non-prior-service Male Enlistments

	Forecasts of Enlistments (in thousands)		Navy Enlistment Supply Elasticities	
FY	MG I-IIIA	All HSDGs	Explanatory Variable	MG I-IIIA HSDGs
1984	40.2	69.4	Constant	-.57
1985	39.6	68.4	Relative pay	.93
1986	39.2	67.6	Unemployment	.29
1987	38.9	67.1	Loss of GI bill	-.15
1988	39.0	67.3	ETA youth	.039
1989	38.6	66.6	ETA countercyclical	-.086
1990	38.0	65.6	Navy recruiters	.74
			% black population	-.0062
			Total population	.12
			R^2	.63
			Ser	.19

Note.

This table was derived from an economic model developed by Goldberg (1982). The projections presented herein were based upon the following assumptions:

1. Relative military pay will increase by 9.3 percent.
2. Unemployment will be 6.7 percent in each year.
3. ETA youth programs will decline by 25.5 percent.
4. Countercyclical ETA programs will decline by 94.6 percent.
5. The number of recruiters will fall by 5.5 percent.
6. Population (total and blacks) will trend downward by 7.6, 11.1, 13.9, and 15.6% in 1984, 1985, 1986, and 1987-90 respectively.

These assumed changes in the supply factors through 1990 are based on 1980 levels. They also apply uniformly across all Navy recruiting districts.

economic variables (e.g., unemployment). Despite this caveat, these models are easy to use and do provide gross estimates of the impact of potential policy changes.[1]

Although econometric models are extremely useful, the interpretation of estimates and projections derived from them must be viewed with extreme caution. Aside from standard econometric problems relating to specification of functional form and choice of

[1]For example, to assess the impact of an additional recruiter, the estimated coefficient of the recruiter variable usually indicates either the marginal or percentage change in enlistments.

appropriate statistical estimation technique, econometric supply models bear additional scrutiny. One key issue is the definition of supply itself for, in fact, the observed value of high-quality contracts/accessions is, in many instances, the intersection of supply and demand--not exclusively supply. Clearly, observed contracts and accessions result from an interplay between the market for qualified individuals and the effort put forward to bring them into the military. Since the use of "observed high-quality accessions/contracts" as a proxy for "supply of high-quality individuals" may be questionable, so may be the meaningfulness of the estimated coefficients and projections of econometric supply models.

Another serious drawback to the utility of econometric models derives from a general problem inherent in the use of regression models. Parameters of regression models are measures of association, not causality. Thus, while econometric models measure historical relationships between independent variables and observed contracts/accessions, they do not explain why these relationships occurred. For example, Table 6 shows a negative coefficient of .0062 percent for the black population. Since this is, in part, a cross-sectional model, this result implies that areas with greater percentages of blacks yield fewer high-quality accessions/contracts. Many possible explanations for this result come to mind; for example, blacks may be less likely than whites to fulfill standards for acceptance into the military, blacks may have less interest than whites in joining the military, less effort may be expended in recruiting blacks, etc., etc. Should such a finding lead to the conclusion that areas with large concentration of blacks should be discounted for purposes of recruitment? As noted, measures of association may imply questionable policies when manipulated as part of "what-if" scenarios.

Econometric models also suffer from an inability to incorporate variables that are not readily quantifiable: Such factors as "patriotism" or "attitude towards the military" are not included. However, as indicated in the section describing interest surveys, these factors have typically been found to be potent motivators in the enlistment decision process (Borack, 1982).

A final concern with econometric models is the fact that they cannot be readily developed for demand-constrained or nontraditional sources of military supply. While informative econometric models have been created for high-quality young males, analogous models for women or "older males" are not available. As such, the supply of individuals from these and other sources cannot be readily assessed through the use of econometric models. Nonetheless, econometric models provide a useful tool for forecasting high quality accession/contracts and, when used carefully, represent a constructive approach for addressing policy issues through relevant independent variables.

Surveys of Interest/Intentions to Join the Military

Surveys are often used as indicators of potential recruitment supply. The Office of the Secretary of Defense (Manpower Reserve Affairs & Logistics) (OSD MRA&L) administers a comprehensive ongoing survey program supplemented by additional ad hoc surveys. The individual services have also administered many ad hoc attitudinal surveys.

Perhaps the most important ongoing survey is the "Youth Attitude Tracking Study" (YATS), which is administered yearly to a representative national sample of approximately 10,000 male youth from 16 to 21 years of age. (A smaller sample of approximately 2,000 women is also queried.) YATS has cross-sectionally gathered information on enlistment propensity and service preferences, reasons for lack of interest, recruiter contacts, awareness and effects of financial incentives, future plans, demographics, etc.

The key barometer of intent to serve in the military (or the individual services) is obtained by asking respondents to indicate how likely they are to serve in the military in the next few years. Responses are made on a four-point scale (definitely, probably, probably not, definitely not), with positive propensity being defined as definitely or probably planning to serve. The question is repeated for the four active duty services, as well as the National Guard, Reserves, and Coast Guard. Similar measures of interest or intent have been used in ad hoc surveys to assess interest in military service (Borack, 1978, 1982).

From the above discussion, it is clear that supply, as defined by the typical military market research survey, relates to the number and composition of individuals who are planning (or are interested in) a military career. Note that this definition is quite dissimilar from that used in econometric models.

Table 7, which presents the response distribution for specific services and overall military propensity measures derived from the Fall 1981 and 1982 YATS, shows that relatively few respondents indicated a definite propensity for military service. Also, observe the relative ranking of the services in FY82 (Air Force, Army, Navy, and Marine Corps). Table 8 segments overall positive military propensity by age and race. It is interesting to observe the relatively high interest rates observed for blacks and hispanics, as well as the declining pattern of interest as a function of age.

Figure 2 displays trends in positive propensity over the Fall 1975-Fall 1982 time frame. Especially noteworthy is the increase in overall propensity that has occurred since Fall 1979. While the Air Force has consistently been the service most preferred, the Army appears to be improving its position relative to the other services.

From the YATS Fall 1982 wave, it was concluded that:

1. Increased positive propensity among certain population subgroups (e.g., blacks) accounted for most of the overall increase in interest.

2. Positive propensity males exhibited greater differentiation in 1982 in their service preferences. Youth were simultaneously positively inclined toward a smaller number of services than in previous surveys (1.69 in 1982 vs. 1.86 in 1981).

3. Starting pay continued to be underestimated by target market youth. Informing them of actual starting pay did not have a net favorable effect on increased aggregate propensity.

4. Unaided awareness of service advertising and total aided plus unaided awareness increased dramatically, especially awareness of advertising by the active duty services.

Additionally, YATS revealed that positive-propensity young males are more likely than negative-propensity males to:

1. Be black or Hispanic.
2. Be currently unmarried.
3. Be employed part-time.
4. Be unemployed and looking for a job.
5. Have less formal education.
6. Be younger.
7. Have a vocational curriculum in high school and less likely to have a college preparatory curriculum.

Table 7

Distribution of Responses (Males Only) for Specific Service and Composite Propensity Measures--Fall 1981 and 1982

	Respondents May be Serving in Next Few Years in:								At Least One Active Duty Service (Composite Propensity)	
	Army		Navy		Marine Corps		Air Force			
	81 (%)	82 (%)	81 (%)	82 (%)	81 (%)	82 (%)	81 (%)	82 (%)	81 (%)	82 (%)
Response										
Definitely	1.9	1.8	1.2	1.4	1.4	1.5	2.4	2.2	5.4	5.5
Probably	11.3	12.7*	12.8	11.6	9.6	9.0	16.1	15.2	25.1	27.2*
Probably not	35.4	38.7*	35.2	39.6*	34.8	38.6*	34.7	39.5*	30.1	33.7*
Definitely not	49.2	45.3*	48.5	45.8*	51.9	49.2*	44.7	41.3*	38.0	32.8*
Don't know/ not sure	2.2	1.4*	2.3	1.6*	2.3	1.7*	2.1	1.8	1.5	0.8*
(Base data)	(5191)	(5982)	(5118)	(5987)	(5193)	(5986)	(5190)	(5979)	(5192)	(5992)

Note. Data obtained from YATS, Fall 1981, Fall 1982.

*The 1981-82 change is statistically significant at the .05 level.

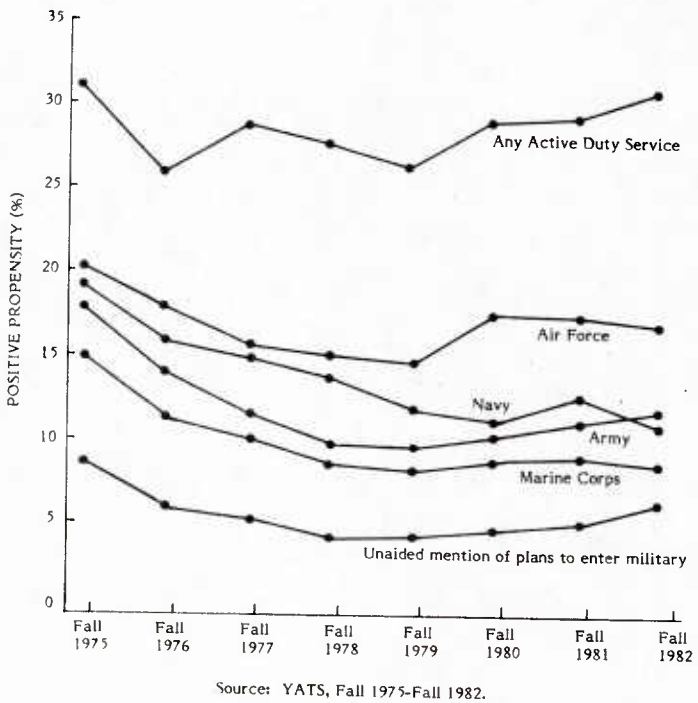
Table 8

Positive Propensity (Males Only) by Race and Age

Item	Fall 1981 (%)	Fall 1981 (N)	Fall 1982 (%)	Fall 1982 (N)	% Change
Race:					
White	27.1	4,275	28.4	4,910	+1.3
Black	47.7	602	55.0	654	+7.3*
Hispanic	46.2	218	49.5	290	+3.3
Other[a]	38.0	164	33.8	244	-4.2
Age (Yrs.):					
16	44.7	1,283	44.3	1,296	-.04
17	39.9	1,282	41.8	1,390	+1.9
18	31.3	885	35.4	1,056	+4.1
19	25.8	742	30.1	919	+4.3
20	22.6	551	24.7	736	+2.1
21	20.7	458	22.9	595	+2.2

Note. Data from YATS, Fall 1981, Fall 1982.

[a]Includes Asians, Pacific Islanders, American Indians, and native Alaskans.



Source: YATS, Fall 1975-Fall 1982.

Figure 2. Positive propensity (males only) to serve in active duty services and unaided mention of plans to enter military.

8. Have scored lower on the quality index.
9. Be planning to attend vocational school.
10. Have less educated fathers and mothers.
11. Perceive greater difficulty in finding full-time job.

Respondent's beliefs relating to job satisfaction, military compensation, and patriotism appear to relate to propensity status (YATS, 1982).

Borack (1982) conducted an ad hoc survey of males 23-29 years old to (1) obtain current estimates of military service intent and (2) evaluate the potential impact of various monetary and nonmonetary incentives upon this nontraditional supply source. Monetary incentives included bonuses, lateral entry pay, and educational benefits; nonmonetary incentives included training, job, and locational guarantees. Figure 3 shows the percentage of respondents indicating positive propensity, as well as comparable results for a younger group surveyed by YATS. As noted earlier, interest declines as a function of age; however, the decline is curvilinear rather than linear. Borack also found that training and locational guarantees were important accession incentives (more than 22% of the respondents stated they were "much more likely to join" if guaranteed training in their first choice of skills). Survey results are summarized below:

1. The propensity of "older" (Borack, 1982) individuals is approximately one-fourth that of "younger" (YATS) individuals.

2. Branch preference was fairly similar among older and younger markets.

3. Demographic profiles of the older market were similar to those of the younger market.

4. The greatest interest was shown by individuals with the fewest alternatives.

5. The older market appears to be a good source of increased supply.

In an earlier survey, Borack (1978) explored the interest of women 18 to 25 years old in joining the military under current (1978) conditions and alternative scenarios involving service in nontraditional female military roles. The survey revealed generally high interest levels under current conditions but also revealed a market that shifted significantly in size and composition under alternative scenarios (e.g., service on ships, aircraft, combat, etc.).

The above is not meant to be a comprehensive list of all ongoing and ad hoc surveys. However, this cross-section is indicative of the strengths and weaknesses of surveys as a component of military supply research. As in the case of econometric models, surveys may be used to provide preliminary input into the development of incentives and to gauge market response. However, surveys measure intent and are not based upon historical actions. Thus, inferences relating to the number and composition of individuals who would react to a new policy are tenuous at best. Also, some individuals who respond positively to surveys may not be qualified to serve in the military, further distorting the meaningfulness of the results. Finally, surveys measure market conditions only at a moment in time. A variety of factors (e.g., international events) may profoundly impact survey responses.

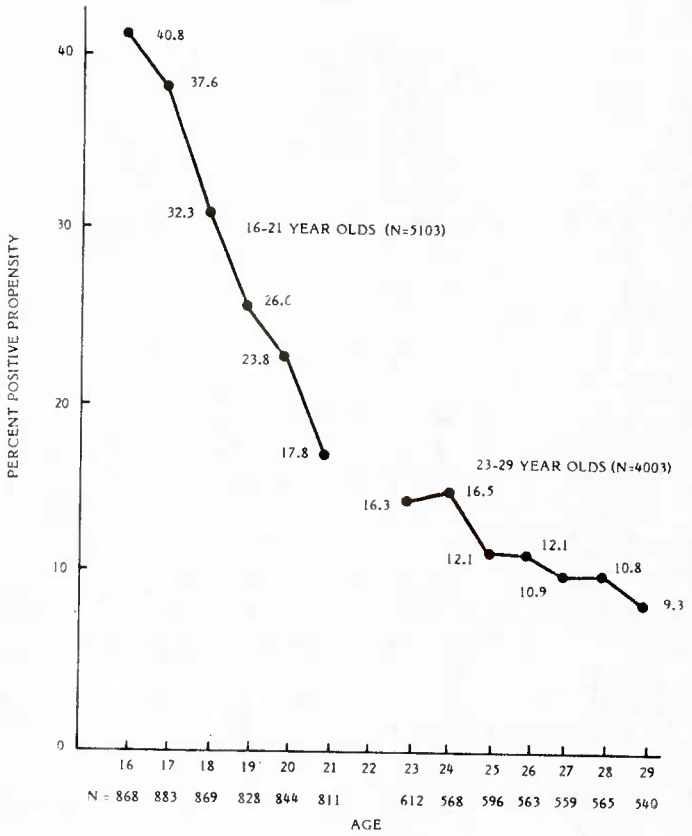


Figure 3. Percent positive propensity as a function of age. No N available for 22-year-olds because none were included in the two surveys.

While intent to join the military may be a dubious supply proxy, surveys are quite useful in measuring the "relative" size of a "supply pool"; that is, they are of enormous value in gauging market size segmented by demographic factors, geographic location, etc. Additionally, the impact or importance of factors not readily measurable through econometric models (e.g., availability of training) may be estimated to some extent through surveys. Most importantly, surveys enable researchers to investigate not only those individuals who choose to join the military but also the entire spectrum of the nation's youth. Thus, they allow researchers to glimpse the population of individuals <u>not</u> electing military service.

Fortunately, as Orvis (1982) notes, there is a strong relationship between responses to the YATS and subsequent enlistment. Figure 4 shows that almost half of those who responded with unaided mention of plans for military service and a definite intention to serve did enlist within 42 months of the survey period. Orvis further observes that the predictive power of the intention measures appears to be greatest within the first 12 to 18 months following the survey. Note the steeper slopes of the enlistment curves in this initial observation period. In addition, the relative steepness of the slopes through the follow-up period demonstrates that the intention measures continue to distinguish persons with different enlistment likelihoods. As such, trends in these surveys may also serve as leading indicators of the likelihood of achieving accession goals.

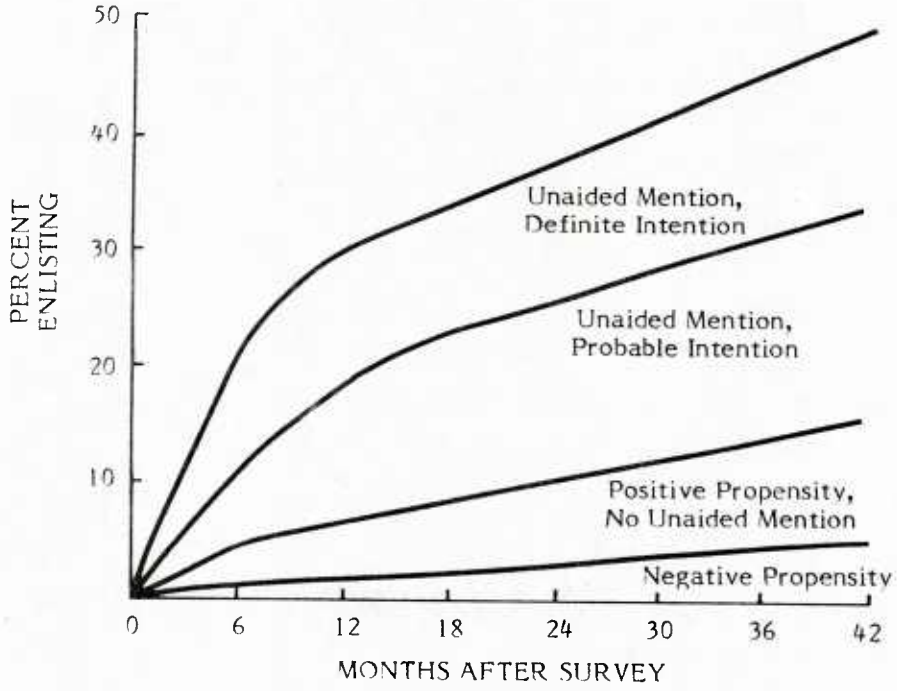


Figure 4. Enlistment rates by intention over time. Source--YATS surveys: Spring 1976-Spring 1978.

Demographic Analyses

Demographic techniques are often used to estimate and project military manpower supply. Typically, demographic data are used to assess the number and mix of individuals qualified (and available) for military service. The term "qualified" refers to the ability of a candidate to fulfill the physical, mental, and moral requirements for entrance into the military. Thus, to a demographic researcher, supply represents the number and mix of individuals able to pass military eligibility requirements.[2]

In general, demographic supply investigations commence with the selection of a suitable "bottom-line" population. Since the preponderance of enlisted accessions consists of "young men," the bottom-line population is generally a variant of the "young" male population, usually determined by age (e.g., 17-21, 18-19 years old, etc.) and/or educational status (high-school senior, high-school graduate, etc).[3] Such data result from projections of current U.S. Bureau of the Census population estimates. However, a bottom-line population need not be restricted to "young" men. Figure 5 presents projections of the "older" (23-29) male population. As shown, the shape is quite different from the analogous curve for younger men (in Figure 1) and shows an upward trend throughout the first half of the 1980s. Such curves provide glimpses into nontraditional manpower markets and may partially explain/predict changes in the demographic composition of accessions. Recall the substantial percentage increase in "older" accessions during recent years.

---

[2]The term "available" will not be discussed here. "Available" has previously been defined as those who do not hold full-time jobs, are not students, etc. (Huck, 1978).

[3]High school graduate status is often used since the likelihood of first-term attrition has been found to be strongly correlated with possession of a high school diploma.

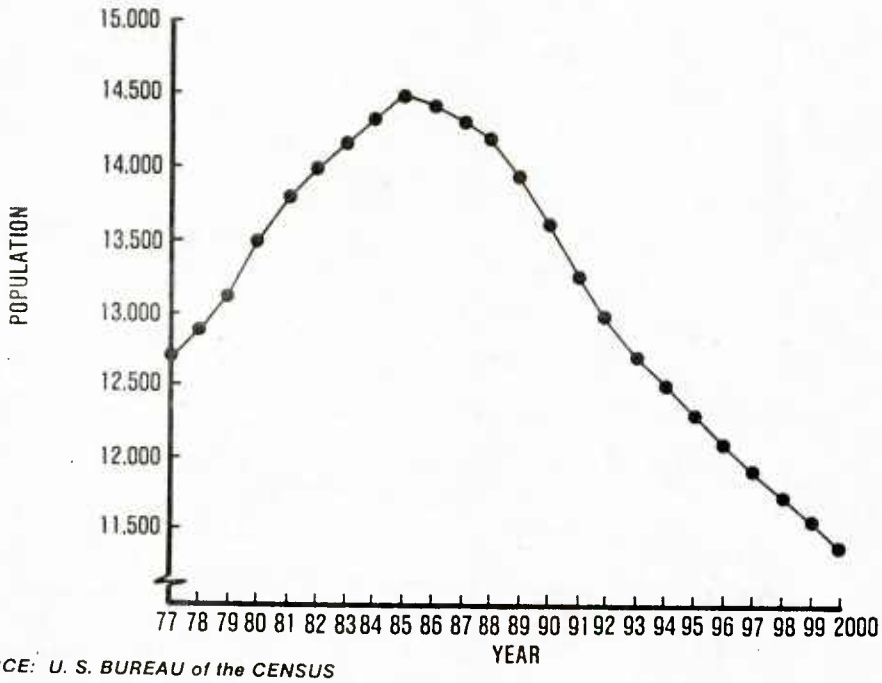


Figure 5. Estimates (in thousands) of U.S. male population age 23-29, including armed forces overseas.

Following selection of a bottom-line population, demographic analyses remove individuals from this population who are unqualified for military service. The principal causes for disqualification are mental and physical/medical, which are discussed below.

Mental Disqualification Rates

Mental disqualification means failure to achieve a minimum score on the AFQT. Since this minimum score has varied over the years (see Cooper, 1977),[4] most attempts to determine the number of individuals who are mentally qualified for military service use techniques for estimating the percentage of individuals within a given AFQT score range. Typically, the AFQT is segmented into mental categories (or grades) based upon percentile score (see Table 9). Most demographic supply studies attempt to estimate the number of individuals within mental grades I-IIIA, I-IIIB, I-IVA, etc., since these groupings are either used as minimum entrance criteria or as standards for technical school eligibility.

Until recently, local- and national-level mental grade distributions were not accurate because a nationally representative sample of America's youth had not been administered a current version of the AFQT. This deficiency was overcome in 1980 when the U.S. Department of Defense, in conjunction with the U.S. Department of Labor, administered the Armed Services Vocational Aptitude Battery (ASVAB) (of which the AFQT is a subset) to a sample of approximately 10,000 youths as part of the National Longitudinal Survey (Department of Defense, 1982). Results were used to obtain estimates of the percentage

[4]Typically, Category V applicants have been rejected. For a fuller discussion, see Karpinos (1975).

Table 9

AFQT Mental Group Categories

Mental Group Category	AFQT Raw Score	AFQT Percentile Score
I	101-105	93-99
II	84-100	65-92
IIIA	76-83	50-64
IIIB	65-75	31-49
IVA	56-64	21-30
IVB	49-55	16-20
IVC	38-48	10-15
V	0-37	1-9

of individuals in each mental grade. When these percentages are combined with additional demographic data, estimates and projections of the number of individuals mentally qualified for military service can be developed at the national level. (Local area estimates of the number of mentally qualified individuals are considerably more difficult to obtain. Since the sample size of the aforementioned study does not permit direct estimation of local area AFQT levels, regression-based techniques that employ correlates of AFQT scores (e.g., educational and socioeconomic variables) or methods that predict AFQT scores based upon more widely administered aptitude exams, must be used.)

Once mental disqualification rates have been established, physical disqualification rates must be estimated.

Physical Disqualification Rates

To determine the size and composition of the population who are mentally and physically qualified to serve in the military, estimates of the percentage of the mentally qualified population who are also physically qualified must be generated. Physical failure rates of military applicants during an AVF environment cannot be used due to a self-selection process. Thus, draft-era data appears to represent the most accurate form of information for use in physical disqualification estimation. However, preliminary examination of such data yields several surprises. Figure 6 presents the percent disqualified for medical reasons on initial draft examination. Unless one believes that America's youth are becoming progressively less able to pass a military physical exam, direct use of these data would seem improper. An obvious explanation for the rise in failure rates during the latter portion of the 1960s and early 1970s is the attempt by many individuals to avoid service during the Vietnam conflict. However, this does not explain the difference between blacks and whites shown in Figure 6. From a cursory examination, one would conclude that blacks are considerably "healthier" than their white counterparts. A seemingly more plausable interpretation of these data was put forward by Karpinos (1967), who noted that many medical and physical conditions go unnoticed if they are not reported by the examinee or revealed in a medical history. Blacks, as well as whites from the south, had less exposure to physicians and medical services; hence, fewer conditions of an adverse nature were detected or reported. Indeed, the relationship between draftees'

physical qualification rates and other forms of general well-being (e.g., education, affluence, and mental grade) was negative. As access to health care becomes more widespread, it would not be unreasonable to assume that these differences would narrow.

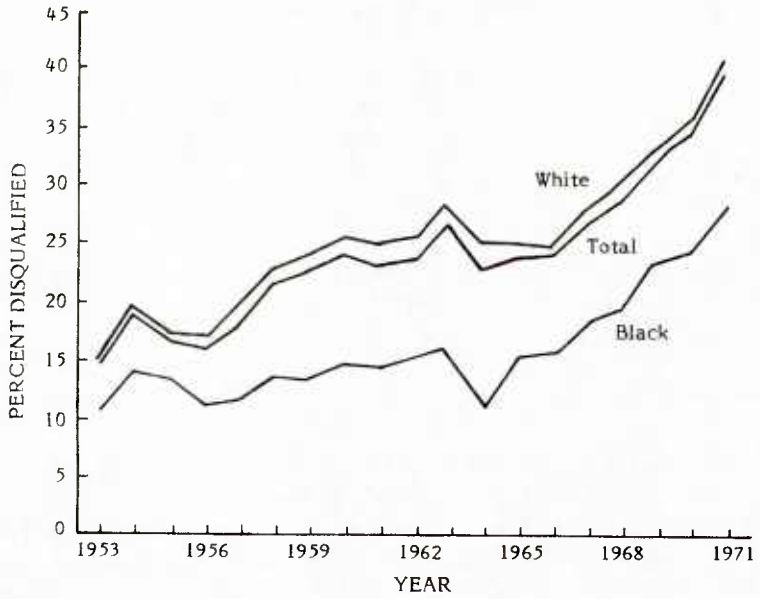


Figure 6. Draftees: Percent disqualified for medical reasons on initial examination, by ethnic group (1953-1971) (Source: Karpinos, 1972).

Disqualification rates in the draft era must be adjusted to account for the fact that an unrepresentative group of individuals complete draft physicals. For example, many individuals who expect to be drafted are likely either to enlist or to join reserve programs. Figure 7 depicts these adjustments for five sets of data. The "corrected" disqualification rates on the right hover around 14 percent. This estimate is reinforced by data from a special study of 18-year-olds carried out during the mid-sixties, as recommended by the President's Task Force on Manpower Conservation (Department of Labor, 1964). President Johnson had directed that all male youths reaching 18 years of age be promptly classified; those found to be eligible would be sent as soon as possible for complete mental and physical examinations. The physical disqualification rate proved to be 16.9 percent; when the percentage failing both the mental and physical was subtracted from this percentage, the result was 13.9 percent for "medical only." This figure was then corrected to 13.5 percent by taking into account those who chose early enlistments. Thus, this figure closely corroborates the corrected draft-era estimates.

Based on data from the Profile of American Youth and relevant U.S. Bureau of the Census population projections, preliminary estimates of the number of male, high school graduates (17-21 years old) who are physically and mentally qualified for military service were obtained using an overall physical disqualification rate of 14 percent. Results are shown in Table 10. These data include high school seniors not yet graduated who may be expected to graduate within a calendar year; they do not include individuals with a graduate equivalency diploma. As shown, trends in these "QMA" estimates parallel trends in Figure 1.

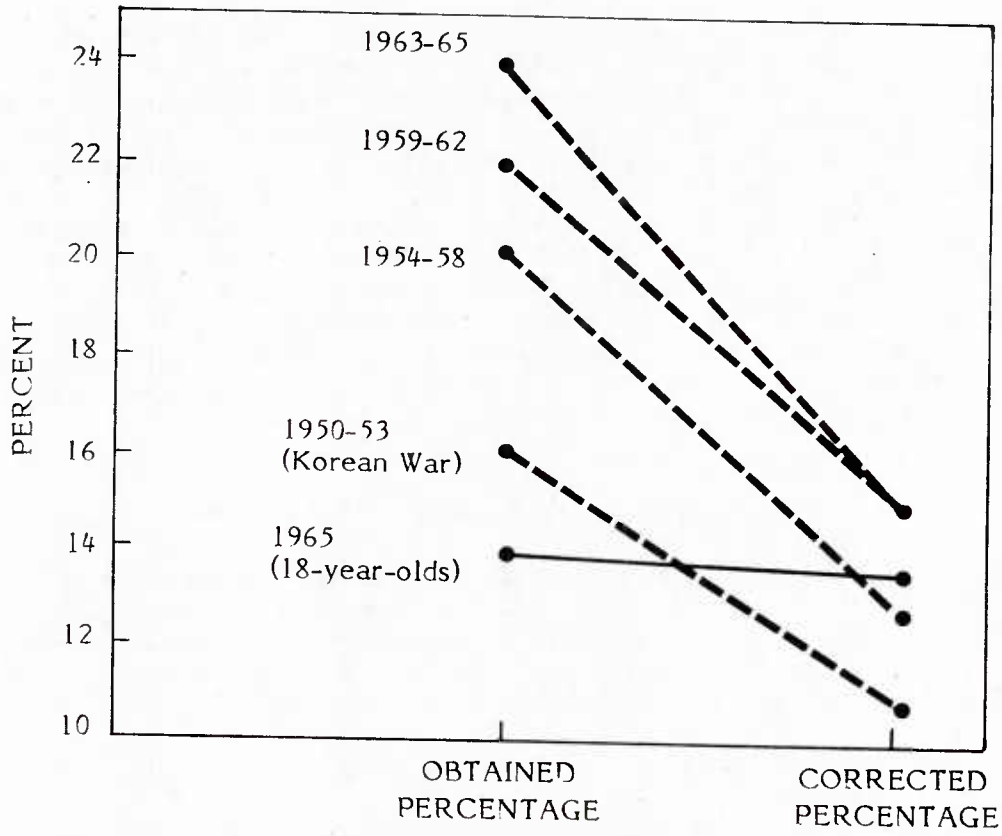


Figure 7. Percent disqualified for medical-physical reasons only (Source: Karpinos 1965, 1967).

Table 10

Total QMAs--17-21-year-old, Male, HSDG

Year	Mental Group	
	I-IIIA	I-IIIB
1983	3,592,633	4,483,766
1984	3,475,066	4,337,210
1985	3,341,768	4,171,256
1986	3,220,734	4,020,412
1987	3,156,710	3,941,101
1988	3,152,835	3,936,551
1989	3,135,234	3,914,920
	% Decline = 12.73	% Decline = 12.69

Note. Includes individuals not yet HSDG who will graduate during the year.

Obviously, demographic techniques are useful, especially for developing national trends and comparing local areas. Additionally, these methods estimate the mix of qualified personnel, permitting the representativeness of both applicants and accessions to the military to be assesed. Unfortunately, demographic approaches do not directly yield estimates of the number of contracts/accessions the military will achieve. Furthermore, they do not provide guidance into the incentives or factors that influence the decision to enlist. Thus, while these methods provide leading indicators of future demographic shifts in the composition of military applicants/accessions (e.g., more older, more hispanic individuals, etc.) and portend potential future supply problems, they do not directly provide estimates of near-term or subsequent accessions/contracts. Of equal importance, they do not by themselves enable decision makers to assess those policies (e.g., number of recruiters, appropriate incentives) that would permit the military to balance supply and demand efficiently.

CONCLUSIONS AND RECOMMENDATIONS

Although each method for studying and defining military manpower supply discussed above contributes valuable information toward understanding of the supply concept, no single technique appears to provide all of the information necessary to establish and maintain an efficient recruitment program. Clearly, a method is needed for integrating the best of these methods into a comprehensive supply framework.

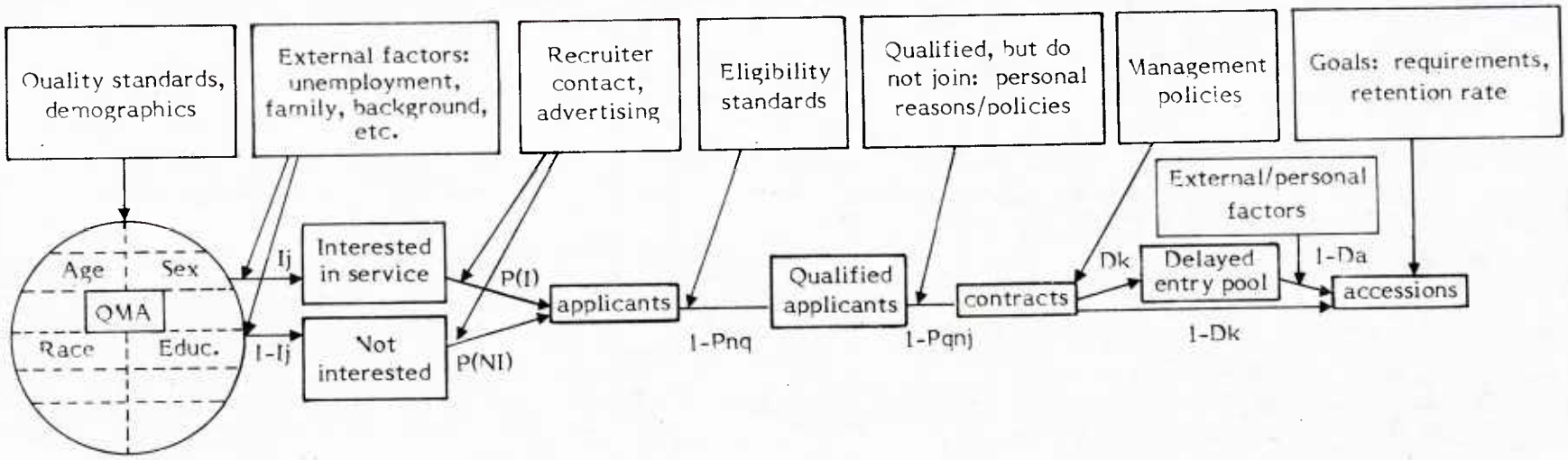
A "good" supply model should have the following characteristics:

1. It should consider the recruitment/accessioning process in conjunction with underlying population demographics.

2. It should use the best demographic techniques to establish accurate "bottom-line" populations and combine them with interest/intent data obtained through surveys as well as germane economic predictors derived from multi-stage econometric models. (Appropriate optimization algorithms could also be integrated to develop "optimal" levels of resources and incentives.)

3. It should describe the supply of individuals from relevant population subgroups (e.g., young men, women, "older" individuals, etc.) for specific military components (e.g., Navy reserves, regular Air Force, etc.). In this way, it would be possible to obtain estimates/forecasts of accessions/contracts of key population segments for each military component, and to measure the disparate effects of policies upon different populations and military sectors. Examples of questions that could be answered are whether or not policies (a) draw individuals away from some military components and into others, (b) improve quality among all military sectors, and/or (c) affect the supply of some population groups relative to others. Such questions can be answered only by means of a structure of integrated models.

Figure 8 presents a diagram of a potential integrated supply framework. The leftmost circle represents the underlying population disaggregated by age, race, sex, region, education, etc. and other demographic variables deemed to be relevant in evaluating the composition or quality of the force. Such data represent the output of demographic analyses and are essential to a proper evaluation of the impact of alterations in military admission standards (physical, mental, etc.) upon supply.



Ij = Proportion of QMAs with jth characteristic that expressed interest in the service (via YATS).
1-Ij = Proportion of QMAs with jth characteristic that expressed no interest in the service (via YATS).
P(I) = Proportion of individuals who previously expressed interest in the service who apply for admission.
P(NI) = Proportion of individuals who previously did not express interest in the service who apply for admission.
1-Pnq = Proportion of applicants who pass service eligibility standards.
1-Pqnj = Proportion of qualified applicants who sign a contract.
Dk = Proportion who enter the delayed entry program.
Da = Delayed entry program attrition rate.

Figure 8. Supply framework.

The arrows leading from this circle represent the proportions of individuals in each of these groups who are either interested in or do not plan to join the military, Navy, etc. This proportion is dependent upon various factors and can be measured through interest surveys. Models should be developed to explain changes in these interest levels.

The next series of boxes, which represent the number and composition of interested individuals, are estimated by the product of the interest percentages and the size of the relevant demographic subgroup. The emerging arrows represent the proportion of interested and uninterested individuals who subsequently apply for military service. (Once again, a model should be developed to describe this process.)

Following application, a certain proportion of candidates (Pnq) will be found to be unqualified for military service. Clearly, this proportion is affected in large measure by changes in eligibility standards as well as by a self-selection process. Therefore, the impact of changes in eligibility standards should entail investigation of both standard demographic data and historical results derived from military applicants. Note also that a certain proportion of qualified applicants will still choose not to join the military. This phenomenon, "qualified but not joining," should be modelled.

The remaining population of individuals qualified and joining either access directly or enter a delayed entry pool (DEP). The proportion who enter the pool directly (Dk) is in large measure determined by management policies. A certain proportion of individuals within the DEP attrite from this pool and do not access. A model to explain this phenomenon must be developed.

Finally, accessions themselves are a combination of supply, as represented by the process just described and manpower demand. Accession goals result from the interaction between stated force requirements and vacancies created through attrition, retirement, failure to reenlist or extend, etc.

The aforementioned framework is not meant to be definitive; rather, it illustrates a general supply prospectus. Its purpose is to present supply as a dynamic interplay rather than a specific model, survey, or analysis. As this engine becomes fine-tuned and its components undergo development, a thorough understanding of the military manpower supply process will, hopefully, be achieved.

REFERENCES

Amey, D. M., Fechter, A. E. , Huck, D. F., & Midlam, K. D. Econometric models of armed forces enlistment levels (OAD-CR-160). McLean, VA: General Research Corporation, October 1976.

Ash, C., Udis, B., & McNown, R. F. Enlistments in the all-volunteer force: A military personnel supply model and its forecasts. American Economic Review, 1983, 73(1), 145-155.

Borack, J. I. Intentions of women (18-25 years old) to join the military: Results of a national survey (NPRDC Tech. Rep. 78-34). San Diego: Navy Personnel Research and Development Center, September 1978. (AD-A060 104)

Borack, J. I. The intentions of men 23 to 29 years old to join the military: Results of a national survey (NPRDC Tech. Rep. 82-62). San Diego: Navy Personnel Research and Development Center, September 1982. (AD-A119 611)

Borack, J. I., & Govindan, M. Projections of the U.S. population of 18-year-old males in the post-1993 period (NPRDC Tech. Rep. 78-16) San Diego: Navy Personnel Research and Development Center, March 1978. (AD-A053 628)

Brown, C. Military enlistments: What can we learn from geographic variation? College Park, MD: Department of Economics, University of Maryland, August 1983.

Cooper, R. V. L. Military manpower and the all-volunteer force (R-1450-ARPA). Santa Monica, CA; Rand Corporation, September 1977.

Cotterman, R. F. A time series of cross sections model for forecasting enlistment supply (WD-1782-MRAL). Santa Monica, CA: Rand Corporation, April 1983.

Cowin, M., O'Conner, F. E., Sage, L. C., & Johnson, C. R. The effects of local economic conditions on Navy enlistment (V-8086-07). Arlington, VA: Information Spectrum, Inc., 18 March 1980. (AD-083 945)

Dale, C., & Gilroy, C. The effects of the business cycle on the size and composition of the U.S. Army. Atlantic Economic Journal, March 1983, 42-53.

Department of Defense. Profile of American youth: 1980 nationwide administration of the Armed Services Vocational Aptitude Battery. Washington, DC: Office of the Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics), March 1982.

Department of Labor. One-third of a Nation: A report on young men found unqualified for military service. Washington, DC: The President's Task Force on manpower conservation, January 1964.

De Vany, A.S., & Saving, T. R. Life-cycle job choice and the demand and supply of entry level jobs: Some evidence from the Air Force. The review of economics and statistics, August 1982, 457-465.

Donelan, J. O. Investigation of goaling models for Navy recruiting (thesis). Monterey, CA: Naval Postgraduate School, March 1977. (AD-039 650)

Fernandez, R. L. Forecasting enlisted supply: Projections for 1979-1990 (N-1297-MRAL). Santa Monica, CA: Rand Corporation, September 1979. (AD-077 190)

Goldberg, L. Enlisted supply: Past, present, and future (CNS-1168). Alexandria, VA: Center for Naval Analyses, September 1982.

Goldberg, L., & Greenston, P. M. A time-series, cross-sectional study of enlistment supply: Army, Navy, Air Force, Marine Corps, 1976-1982. Reston, VA: Economic Research Laboratory, Inc., November 1983.

Greenston, P. M., & Toikka, R. S. The determinants of Navy recruit quality: Theory and evidence, 1970-1977 (Tech. Rep. 1168). Washington, DC: Urban Institute, October 1978. (AD-061 054)

Grissmer, D. W. The supply of enlisted volunteers in the past draft environment: An analysis based on monthly data, 1970-75. Defense Manpower Policy: Presentations from the 1976 Rand Conference on Defense Manpower (R-2396-ARPA). (Richard V. L. Cooper, Ed.). Santa Monica, CA: Rand Corporation, 100-115, December 1977.

Grissmer, D. W., Amey, D. M., Arms, R. L., Huck, D. F., Imperial, J. F., Koenig, L. O., Moore, W. S., Sica, G. P., & Szymanski, R. An econometric analysis of volunteer enlistments by service and cost effectiveness comparison of service incentive programs (OAD-CR-66). McLean, VA: General Research Corporation, October 1974. (AD-001 033)

Hanssens, D. M., & Levien, H. A. An econometric study of recruitment marketing in the U.S. Navy. Management Science, 1983, 29(10), 1167-1184.

Huck, D. F., & Allen, J. Sustaining volunteer enlistments in the decade ahead: The effect of declining population and unemployment. McLean VA: General Research Corporation, June 1978.

Jehn, C., & Shughart, W. F. Recruiters, quotas, and the numbers of enlistments (CNS 1073). Arlington, VA: Center for Naval Analyses, December 1976.

Karpinos, B. D. Review of the results of the examination of 18 year-old youths for military service. Supplement to health of the Army. Washington, DC: Medical Statistics Agency, Office of the Surgeon General, Department of the Army, April 1965.

Karpinos, B. D. AFQT: Historical data. Alexandria, VA: Human Resource Organization, June 1975. (AD-A014 315)

Karpinos, B. D. Results of the examination of youths for military service, 1966. Supplement to health of the Army. Washington, DC: Medical Statistics Agency, Office of the Surgeon General, Department of the Army, March 1967.

Karpinos, B. D. Draftees: Disqualifications for military service for medical reasons--an analysis of trends over time. Alexandria, VA: Human Resources Research Organization, June 1972.

Morey, R. C., & McCann, J. M. Evaluating and improving resource allocation for Navy recruiting. Management Science, 1980, 26(12), 1198-1210.

Orvis, B. R. Forecasting enlistment actions from intention information: Validity and improvement (Note 1954-MRAL). Santa Monica, CA: Rand Corporation, December 1982.

Siegel, B. S., & Borack, J. An econometric model of Navy enlistment behavior (NPRDC Tech. Note 81-16). San Diego: Navy Personnel Research and Development Center, June 1981. (AD-A101 365)

Thomas, G. Feasibility of modelling the supply of older-age accessions (NPRDC Tech. Rep. 83-17). San Diego: Navy Personnel Research and Development Center, May 1983. (AD-A014 315)

Van Doren, W. R. Demand and supply of high quality sailors (thesis). Monterey, CA: Naval Postgraduate School, December 1981. (AD-115 200)

Youth Attitude Tracking Study. Arlington, VA: Market Facts, Inc. Fall 1975 to Fall 1982.

BIBLIOGRAPHY

Abellera, J. W. Prospects for sustaining the peactime all-volunteer force, 1976-1985 (Staff Issue Paper). Washington, DC: Defense Manpower Commission, March 1976.

Cirie, J. A., Miller, J. J., & Sinaiko, H. W. (Eds.). Department of Defense and Navy personnel supply models (TR-9). Washington, DC: Smithsonian Institution, May 1981.

Falk, S. L., Gershater, E. M., & Simpson, G. L. Defense manpower. Washington, DC: Industrial College of the Armed Forces, 1974.

General Accounting Office. Revising medical fitness policies could provide additional quality recruits at less cost than enlistment incentives. Washington, DC: April 1982.

General Research Corporation. Methodology for estimating the size and characteristics of the Army recruiting marketplace. Mclean, VA: May 1975.

Hause, J. C., & Fisher, A. C. The supply of first-term enlisted manpower in the absence of a draft. Arlington, VA: Institute for Defense Analyses, April 1968.

Kim, C., Nestel, G., Phillips, R. L., & Borus, M. E. The all-volunteer force: An analyses of youth participation, attrition, and reenlistment. Columbus, OH: Ohio State University, Center for Human Resource Research, July 1982.

Kim, C. Youth and the military service: 1980 national longitudinal survey studies of enlistment, intentions to serve, reenlistment, and labor market experience of veterans and attriters. Columbus, OH: Ohio State University, Center for Human Resource Research, May 1982.

Kim, C. The all-volunteer force: 1979 NLS studies of enlistment, intentions to serve, and intentions to reenlist. Columbus, OH: Ohio State University, Center for Human Resource Research, July 1982.

National Opinion Research Center. High school and beyond: A national longitudinal study for the 1980s. Chicago, 1980.

Peng, S. S., Fetters, W. B., & Kolstud, A. J. High school and beyond: A capsule description of high school students. Washington, DC: National Center for Education Statistics, 1981.

Sinaiko, H. W., Levien, H. A., & Grafton, R. B. Navy personnel supply (TR-8). Washington, DC: Smithsonian Institution, September 1979.

DISTRIBUTION LIST

Chief of Naval Operations (OP-01B), (OP-01B7), (OP-13), (OP-135C4), (OP-140F2), (OP-987H)
Chief of Naval Material (NMAT 0722)
Chief of Naval Research (Code 270), (Code 440) (3), (Code 442), (Code 442PT)
Chief of Naval Education and Training (N-21)
Commandant of the Marine Corps (MPI-20)
Commander Naval Military Personnel Command (NMPC-013C)
Commander Navy Recruiting Command
Commanding Officer, Naval Aerospace Medical Institute (Library Code 12) (2)
Commanding Officer, Naval Technical Training Center, Corry Station (Code 101B)
Commanding Officer, Naval Training Equipment Center (Technical Library) (5), (Code N-1)
Commanding Officer, Office of Naval Research Branch Office, Chicago (Coordinator for Psychological Sciences)
Superintendent, Naval Postgraduate School (Chairman, Department of Administrative Sciences)
Commander, Army Research Institute for the Behavioral and Social Sciences, Alexandria (PERI-ASL), (PERI-ZT), (PERI-SZ)
Commander, Air Force Human Resources Laboratory, Brooks Air Force Base (Manpower and Personnel Division), (Scientific and Technical Information Office)
Commander, Air Force Human Resources Laboratory, Williams Air Force Base (AFHRL/OT), (CNET Liaison Office AFHRL/OTLN)
Commander, Air Force Human Resources Laboratory, Wright-Patterson Air Force Base (AFHRL/LR)
Commanding Officer, U.S. Coast Guard Research and Development Center, Avery Point
Institute for Defense Analyses, Science and Technology Division
Defense Technical Information Center (DDA) (12)

U211691

DEPARTMENT OF THE NAVY

NAVY PERSONNEL RESEARCH AND
DEVELOPMENT CENTER
SAN DIEGO, CALIFORNIA 92152

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE $300

POSTAGE AND FEES PAID
DEPARTMENT OF THE NAVY
DOD-316

U.S.MAIL

SUPERINTENDENT
NAVAL POSTGRADUATE SCHOOL
MONTEREY
CA 93940

0142